

FORM PTO-1390 (REV. 1-98)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER 41577/266063	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (if known, see 37 CFR 1.51) 10/019907 UNKNOWN	
INTERNATIONAL APPLICATION NO. PCT/GB99/01470		INTERNATIONAL FILING DATE 10 May 1999 (10.05.99)		PRIORITY DATE CLAIMED	
TITLE OF INVENTION SMART POROUS FILM OR MATERIAL					
APPLICANT(S) FOR DO/EO/US DAWSON, Colin and VINCENT, Julian					
<p>Applicants herewith submit to the United States Designated/Elected Office (DO/EO/US) the following items and other information:</p> <ol style="list-style-type: none"> <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. <input type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 37 (b) and PCT Articles 22 and 39(1). <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. <input checked="" type="checkbox"/> A copy of the International Application as published (35 U.S.C. 371(c)(2)) <ol style="list-style-type: none"> <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). <input type="checkbox"/> has been transmitted by the International Bureau. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). <input type="checkbox"/> A translation of the published International Application into English (35 U.S.C. 371(c)(2)). <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) <ol style="list-style-type: none"> <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). <input type="checkbox"/> have been transmitted by the International Bureau. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. <input checked="" type="checkbox"/> have not been made and will not be made. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). Unexecuted <input type="checkbox"/> A translation of the annexes of the International Preliminary Examination Report under PCT Article 36 <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.197 and 1.98 <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. <input checked="" type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. <input type="checkbox"/> A substitute specification. <input type="checkbox"/> A change of power of attorney and/or address letter. <input checked="" type="checkbox"/> Other items or information: <ol style="list-style-type: none"> Certification Under 37 CFR 1.10 <p>I hereby certify that this document is being mailed to Box PCT, Commissioner for Patents, Washington, D.C. 20231, via "Express Mail Post Office to Addressee" on this 9th day of November, 2001, Express Mail Label No. EL20960002005</p> <p><i>Angela M. Rossi</i> Angela M. Rossi b. Version with markings to show changes made c. International Preliminary Examination Report</p>					

U.S. APPLICATION NO. 10/019907 unknown		INTERNATIONAL APPLICATION NO. PCT/GB99/01470		ATTORNEY'S DOCKET NUMBER 41577/286063	
<p>17. <input checked="" type="checkbox"/> The following fees are submitted BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):</p> <p>Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(e)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1,040.00</p> <p>International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$890.00</p> <p>International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(e)(2) paid to USPTO \$740.00</p> <p>International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$710.00</p> <p>International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00</p> <p>ENTER APPROPRIATE BASIC FEE AMOUNT = \$890.00</p>				<p>CALCULATIONS PTO USE ONLY</p>	
<p>Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).</p>				<p>\$130.00</p>	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$	
Total claims	28	08	X \$18.00	\$144.00	
Independent claims	02	00	X \$84.00	\$00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$280.00	\$00	
TOTAL OF ABOVE CALCULATIONS				=	\$1,064.00
Reduction of 1/2 for filing by small entity, if applicable.				--	\$00
SUBTOTAL				=	\$1,064.00
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).					\$00
TOTAL NATIONAL FEE				=	\$1,064.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40 per property					\$00
TOTAL FEES ENCLOSED				=	\$1,064.00
				Amount to be refunded:	\$
				charged:	\$
<p>a. <input checked="" type="checkbox"/> Check in the amounts of \$1,064.00 is enclosed.</p> <p>b. <input type="checkbox"/> Please charge my Deposit Account No. 11-0855 in the amount of \$_____ to cover the above fees. A duplicate copy of this sheet is enclosed.</p> <p>c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 11-0855.</p>					
<p>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(e) or (b) must be filed and granted to restore the application to pending status.</p>					
<p>Customer No. 23370</p> <p>SEND ALL CORRESPONDENCE TO:</p> <p>John S. Pretz, Esq. KILPATRICK STOCKTON LLP 1100 Peachtree Street, Suite 2800 Atlanta, Georgia 30309-4530</p>					
				<p><i>Dean W. Russell</i></p> <p>SIGNATURE</p> <p>Name: Dean W. Russell Registration No. 33,452</p>	

IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

Applicants: Colin DAWSON and Julian VINCENT

International
Application No.: PCT/GB99/01470

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Filing Date: 10 May 1999 (10.05.99)

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For: SMART POROUS FILM OR MATERIAL

Box PCT
Commissioner for Patents
Washington, D.C. 20231

Attorney Docket No. 41577/266063
Date: 11 March 2002

SECOND PRELIMINARY AMENDMENT

Sir:

On page 1, immediately following the title "Smart Porous Film or Material" kindly
insert the following paragraph:

--This application claims priority to International Application No. PCT/GB99/01470
filed on May 10, 1999 and published in English as International Publication No. WO
00/68003 on November 16, 2000.--

Respectfully submitted,



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Date: 11 March 2002

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"Smart Porous Film or Material"
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6. (Amended) A smart film or material according to claim 2 wherein the discrete areas are provided by a printing process.
7. (Amended) A smart film or material according to claim 2 wherein the discrete areas are provided by an etching process.
8. (Amended) A smart film or material according to claim 2 wherein the discrete areas and the layer which they cover or all the layers are cut using a laser or a punch.
9. (Amended) A smart film or material according to claim 1 wherein the discrete areas and the layer which they cover or all the layers are cut so as to provide at least 3 close fitting flaps through the film or material.
10. (Amended) A smart film or material according to claim 2 wherein at least some of the discrete areas are individually surrounded by a further discrete area which has fluid absorption properties different to the rest of the layer, the further discrete area being disposed from the discrete area which it surrounds.
12. (Amended) A smart film or material according to claim 1 wherein the layer or one of the layers is substantially impermeable.
13. (Amended) A smart film or material according to claim 2 wherein the layer or one of the layers is permeable.
14. (Amended) A smart film or material according to claim 2 which forms one element of a multi-element textile.

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15. (Amended) A smart film or material according to claim 2 wherein the layers have different hydrophilic properties to each other.

16. (Amended) A smart film or material according to claim 2 wherein the layer and the discrete areas have different hydrophilic properties.

Please cancel claim 17 without prejudice.

Please add the following new claims 18-29.

18. (New) A smart film or material according to claim 1 configured so as to be suitable for use in clothing.

19. (New) A smart film or material according to claim 1 wherein the discrete areas are produced by attaching a material having different fluid absorption properties to the surface of the layer.

20. (New) A smart film or material according to claim 2 wherein the discrete areas are areas of the layer which have been plasma treated or treated with chemicals or radiation so as to modify their fluid absorption properties.

21. (New) A smart film or material according to claim 1 wherein the discrete areas are provided by a printing process.

22. (New) A smart film or material according to claim 1 wherein the discrete areas are provided by an etching process.

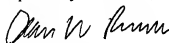
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23. (New) A smart film or material according to claim 1 wherein the discrete areas and the layer which they cover or all the layers are cut using a laser or a punch.
24. (New) A smart film or material according to claim 1 wherein the discrete areas and the layer which they cover or all the layers are cut so as to provide at least 3 close fitting flaps through the film or material.
25. (New) A smart film or material according to claim 1 wherein at least some of the discrete areas are individually surrounded by a further discrete area which has fluid absorption properties different to the rest of the layer, the further discrete area being disposed from the discrete area which it surrounds.
26. (New) A smart film or material according to claim 25 wherein at least one of the further discrete areas is provided in the form of a hoop.
27. (New) A smart film or material according to claim 1 wherein the layer or one of the layers is substantially impermeable.
28. (New) A smart film or material according to claim 1 wherein the layer or one of the layers is permeable.

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29. (New) A smart film or material according to claim 1 which forms one element of a multi-element textile.

Respectfully submitted,



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3. (Amended) A smart film or material according to claim[s] 1 or 2 configured so as to be suitable for use in clothing.
4. (Amended) A smart film or material according to claim 2 [or 3] wherein the discrete areas are produced by attaching a material having different fluid absorption properties to the [layer of the] surface of the layer.
5. (Amended) A smart film or material according to claim 2 [or 3] wherein the discrete areas are areas of the layer which have been plasma treated or treated with chemicals or radiation so as to modify their fluid absorption properties.
6. (Amended) A smart film or material according to claim 2 [or 3] wherein the discrete areas are provided by a printing process.
7. (Amended) A smart film or material according to claim 2 [or 3] wherein the discrete areas are provided by an etching process.
8. (Amended) A smart film or material according to [any of the preceding] claim[s] 2 wherein the discrete areas and the layer which they cover or all the layers are cut using a laser or a punch.
9. (Amended) A smart film or material according to [any of the preceding] claim[s] 1 wherein the discrete areas and the layer which they cover or all the layers are cut so as to provide at least 3 close fitting flaps through the film or material.

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10. (Amended) A smart film or material according to claim 2 [or 3] wherein at least some of the discrete areas are individually surrounded by a further discrete area which has fluid absorption properties different to the rest of the layer, the further discrete area being disposed from the discrete area which it surrounds.

12. (Amended) A smart film or material according to [any of the preceding] claim[s] 1 wherein the layer or one of the layers is substantially impermeable.

13. (Amended) A smart film or material according to [any of the preceding] claim[s] 2 wherein the layer or one of the layers is permeable.

14. (Amended) A smart film or material according to [any of the preceding] claim[s] 2 which forms one element of a multi-element textile.

15. (Amended) A smart film or material according to claim [1 or 3] 2 wherein the layers have different hydrophilic properties to each other.

16. (Amended) A smart film or material according to claim 2 [or 3] wherein the layer and the discrete areas have different hydrophilic properties.

18. (New) A smart film or material according to claim 1 configured so as to be suitable for use in clothing.

19. (New) A smart film or material according to claim 1 wherein the discrete areas are produced by attaching a material having different fluid absorption properties to the surface of the layer.

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20. (New) A smart film or material according to claim 2 wherein the discrete areas are areas of the layer which have been plasma treated or treated with chemicals or radiation so as to modify their fluid absorption properties.
21. (New) A smart film or material according to claim 1 wherein the discrete areas are provided by a printing process.
22. (New) A smart film or material according to claim 1 wherein the discrete areas are provided by an etching process.
23. (New) A smart film or material according to claim 1 wherein the discrete areas and the layer which they cover or all the layers are cut using a laser or a punch.
24. (New) A smart film or material according to claim 1 wherein the discrete areas and the layer which they cover or all the layers are cut so as to provide at least 3 close fitting flaps through the film or material.
25. (New) A smart film or material according to claim 1 wherein at least some of the discrete areas are individually surrounded by a further discrete area which has fluid absorption properties different to the rest of the layer, the further discrete area being disposed from the discrete area which it surrounds.
26. (New) A smart film or material according to claim 25 wherein at least one of the further discrete areas is provided in the form of a hoop.
27. (New) A smart film or material according to claim 1 wherein the layer or one of the layers is substantially impermeable.

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28. (New) A smart film or material according to claim 1 wherein the layer or one of the layers is permeable.

29. (New) A smart film or material according to claim 1 which forms one element of a multi-element textile.

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SMART POROUS FILM OR MATERIAL

The present invention relates to smart films and materials particularly those which can modify their porous properties and can be used in clothing.

- 5 When covering objects with a protective film or material it is often desirable for the film or material to be capable of allowing fluids, such as liquids and gases, to pass from the object through the film or material to the surrounding environment.

- Examples of this requirement can be found particularly in clothing
10 where a variety of Moisture Vapour Permeable (MVP) materials are known which allow water vapour to pass through the garment thus removing a proportion of the sweat generated by a wearer. These materials are also widely used in the medical field in the form of bandages and dressings. Also known are materials such as Stomatex
15 (RTM) which is a rubber material having a number of perforations spread throughout the material. The material has pockets below each perforation configured so as to allow a local build-up of vapour pressure before allowing the gases through. In both the clothing and medical uses these materials perform their specific
20 function but are limited in that they can only remove gases and vapours and have a limited performance which is constant and does not change in response to environmental changes. Thus under extreme conditions the material will not be able to function satisfactorily. Clothing includes gloves, hats and footwear.

- 25 An aim of the present invention is to provide a smart porous film or material which automatically controls its porous properties in

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relation to changes in its local environment thus allowing fluids to pass through the film or material in a controlled fashion.

Accordingly, the present invention provides a smart film or material comprising at least two layers having different fluid absorption properties wherein all the layers are cut so as to provide a plurality of close fitting flaps through the film or material such that any strain differences between the layers caused by their different fluid absorption properties will cause the flaps to bend providing a plurality of openings in the layer.

As an alternative, the present invention also provides a smart film or material comprising a layer, a surface of which has discrete areas which have fluid absorption properties different to the rest of the layer wherein the discrete areas and the layer which they cover are cut so as to provide a plurality of close fitting flaps through the film or material such that any strain difference between the discrete areas and the layer which they cover, caused by their different fluid absorption properties, will cause the flaps to bend thus providing an opening in the layer.

The bending of the flaps is a result of the layers having different affinities for a fluid in the local atmosphere or the discrete areas having a different affinity for a fluid than layer which they cover.

One example of this effect is where a discrete area has different hydrophilic properties to the layer it covers or the layers have different hydrophilic properties to each other.

In a more specific example a discrete area could be arranged to take in more water or water vapour from the local atmosphere than the layer which it covers it then expands causing a strain difference between it and the layer which it covers. This strain difference causes the flaps to bend in the most energetically favourable direction.

The advantage of the above is that a film or material whose porosity can change in a controlled manner in response to changes in its local environment is provided.

In use the layer or one of the layers can be substantially impermeable such that fluids cannot pass through the film or material except via the openings caused through the film or material. Alternatively the layer or one of the layers can be permeable, in such an embodiment the amount of fluid which can pass through the film or material is increased or decreased by the opening or closing of the flaps through the film or material.

Advantageously one of the layers can be made of a polymer fibre with increased fluid absorption properties such as a polyethylene oxide macromolecular polymer covered by nylon such as Hygra™.

The discrete areas can be produced in the form of materials individually deposited on a surface of the layer, possibly using some form of chemical bond, by a printing process such as dot printing, by transfer coating or spread coating or by any other means which is capable of accurately depositing small amounts of a material on a surface. Alternatively the discrete areas can be produced by an etching process whereby a further layer is attached

to the surface of the layer and areas of the further layer are etched away to leave the discrete areas.

The discrete areas deposited on a surface of the layer can be a hydrophilic gel or gel mixture or other suitable material. Such materials may contain, singly or in combination, polyvinyl alcohol, partially hydrolysed polyvinyl acetate, poly(vinylpyrrolidone), polyethylene glycol, ethoxylated polyethylene glycol, polysiloxane, ethoxylated polysiloxane, poly(acrylic acid), copolymers of acrylic acid, poly(N-isopropylacrylamide), poly(2-acrylamide-2-methylpropanesulphonic acid), collagen, gelatin, pectin, starch, in each case optionally cross-linked by incorporation of an appropriate physical cross-linking agent, e.g. borax, or chemical cross-linking agent, e.g. ethylene-bis-acrylamide, and suitable catalysts, e.g. lactic acid, or free radical initiators, e.g. azo-bis-isobutyronitrile, and compatible vegetable or mineral fillers, as has all been described in literature regarding such materials.

The discrete areas can also be formed by locally modifying the layer's fluid absorption properties thus avoiding the need to bond the discrete areas to the layer this can be done by plasma treating a surface of the layer or by treating a surface of the layer with chemicals or radiation. For example, exposing a material composed of an uncrosslinked polymer to a source of high energy radiation (such as UV light or gamma rays) or ionic particles (such as a plasma) it is possible to form crosslinks between the polymer molecules. If the initial starting material is hydrophilic it will be made more hydrophobic by this treatment and the material may also become stiffer.

Advantageously the discrete areas can be only a few millimetres in diameter and can be dispersed over the entire layer, or in specific locations of the layer, in a density defined by the level of porosity required of the film or material. The size of the

5 discrete areas will in practice be limited by manufacturing techniques and the ability to make accurate, small cuts through the film or material.

Obviously larger discrete areas can be provided should large openings be required such as would be needed to allow liquids

10 instead of gases to pass through the film or material.

The cutting of the flaps is preferably done so as to form a plurality of flaps which are located in a close fitting arrangement, i.e. the amount of material removed during cutting should be kept to a minimum. This is advantageous as it aims to

15 maintain as much of the properties of the uncut film or material as is possible. Usefully this can be done using laser, water jet or punching techniques.

Any number of close fitting flaps can be provided at a single location in the film or material however a minimum of 3 flaps will

20 allow the flaps to bend easily providing an opening. Further flaps would increase the size of opening produced at each location, however, the cutting procedure increases in complexity, and the amount of material removed will be increased, as more cuts are needed. The removal of more material will increasingly affect the

25 overall properties of the film or material when the flaps are closed.

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An additional improvement of the invention can be obtained by causing a further discrete area which has fluid absorption properties different to the rest of the layer to be formed, which individually surrounds some or all of the discrete areas and is disposed from the discrete area it surrounds. This can be done in the form of a hoop. When the environment adjacent to a further discrete area changes the strain differences between the layer and the further discrete area, as a result of their different fluid absorption properties, causes a pocket or bulge to form in the film or material. Provision of a pocket or bulge beneath the opening formed by the flaps may improve the efficiency of the proposed system. For example, when the pocket or bulge is formed the concentration of a gas, such as water vapour, could be allowed to build up to high levels before the flaps formed in the discrete area are caused, as a result of strain differences between the layers of the flap, to bend thus forming an opening. Once the opening has formed gas exchange between the pocket or bulge and the environment can occur by a process of diffusion. Diffusion is driven by concentration gradients and as such this process of gas exchange is increased by the high concentration of gas in the pocket or bulge and would quickly reduce the level of gas inside the chamber thus allowing the flaps to close. This also reduces the amount of time that the flaps are required to be open.

A film or material according to the present invention can be used in a variety of applications. These applications include use in clothing, medical applications, food wrappings and structures such as tents and garden cloches.

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When in use as a clothing material the material can be arranged to have a predetermined porosity which will be capable of being increased by the opening of the flaps in response to changes in the local environment caused by the actions of the wearer. This could possibly be as a result of an increase in the workload of the wearer causing the wearer to become hotter thus requiring an increased amount of fluid, either in the form of moisture vapour or sweat, to be removed from the body. This opening of the flaps could be arranged to occur as a response to an average level of fluid absorption in the film or material or only to occur at extreme levels to reduce heat stress under heavy exertion.

Medical uses of a film or material according to the present invention include uses in bandages or dressings for wounds where it is desirable to either keep the covered area dry or allow gases to escape from the covered area. Again a film or material could be arranged such that the flaps open under average conditions or the flaps could be arranged to open only under extreme conditions.

Uses as food wraps are similar to the medical uses where food needs either to be kept dry or free from a build up of gases. Particular uses in food wraps are where the film or material absorbs gases naturally emitted from the food causing pores to open and thus allowing the gases to be released.

When used in structures such as tents or garden cloches the film or material can prevent the build up of condensation on the inside of the structure or it can allow gases given off from within the structure to escape.

As stated the film or material will be made more porous by the cuts made in it, even when the resulting flaps are closed, unless these cuts can be made to be so close fitting so as to render them impermeable or the cuts are made under tension such that when released the flaps are in close contact with each other. As such the smart film or material may be required to be combined with further materials, possibly using moisture vapour permeable materials or tufted, embedded or woven hairs or fibres, to provide the required overall properties. Another material which could be used is a fur-mimetic material acting as an outer layer to provide protection from rain.

Various materials can be used to produce smart porous textiles according to the present invention. Materials which absorb water and could be coated onto or extruded with a non-absorbing layer include Polyurethanes, Polyether block amides (PEBA), Hydrogels and Water Soluble polymers such as polyvinylpyrrolidone, carboxyl methyl cellulose and polyvinyl alcohol.

The following are, by way of example only, four examples of methods of manufacturing materials in accordance with the present invention:

Example 1

A 2x2 200 gsm polyester plainweave fabric is passed through a solution of primer and after drying is stippled with a jet printer dot paste coating and immediately contacted with a powder comprising a 1:1 dry blend of polyvinyl alcohol and polyacrylic acid, pressure being applied by a heated roll at 170 deg C.

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The resulting 5mm diameter adhered disks are present at a surface density of two per square centimetre in a regular grid pattern.

The fabric is subsequently passed intermittently through the work zone of a focused and collimated indexing Carbon Dioxide laser which irradiates each disk area in turn producing cruciform slots
5 each 0.3mm in width and 3mm in length through the disk area.

Example 2

A previously degreased 300gsm polyester cored cotton plainweave fabric is passed through the Nitrogen atmosphere work zone of an indexed scanning electron beam (300KeV, 15mA) traversing the full
10 width of fabric at a lateral sweep velocity of 25m/min.

Acrylic Acid is sprayed onto one side of the fabric in striated zones and the fabric passed through a drying oven at 100 deg C with a residence time of 10 minutes followed by cooling to room
15 temperature over a further 10 minutes with fan assist.

The add on weight of polyacrylic acid is 200 gsm in the areas treated.

The fabric is subsequently punched with a cruciform pattern in the region of the striations only to give a pore density of one pore
20 per square centimetre, the pores being 5mm long in each orthogonal direction.

Example 3

A previously degreased 300gsm polyester cored cotton plainweave fabric is activated by electron beam exposure in selected zones
25 and is then fully coated with N-vinylpyrrolidone containing 0.5%

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by weight of N.N-methylene-bis-acrylamide. The fabric could also be activated chemically by treatment with any of peroxydisulphuric acid, chromic acid, ferric chloride/hydrogen peroxide or peroxyacetic acid.

- 5 The fabric is passed through a ventilated drying oven at 70 degrees C with residence time of 10 minutes followed by a further 10 minutes cooling with fan assist.

The fabric is then passed through a water bath with agitation to dissolves away the unfixed coating leaving a fabric having poly(N-
10 vinylpyrrolidone) coating (200gsm) in irradiated zones only.

The fabric is then punched to form cruciform cuts.

Example 4

- An A4 specimen of 60gsm microfibre polyester woven fabric is laid
15 on foil and the exposed surface treated for 10 minutes in a cold plasma barrel reactor with a maintained rarefied atmosphere of nitrogen containing 20% v/v N-vinylpyrrolidone (0.05 Torr) excited by a 100W microwave field (433MHz).

The polyester fabric is then exposed to a scanning and indexing
20 CO2 laser to receive cruciform cuts.

The textile has become hydrophilic on one side, while remaining hydrophobic on the other.

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An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, wherein

Fig 1. Shows a plan view of a smart porous material according to the present invention, the stippled areas indicating the smart discrete areas of the material.

Fig 2. Shows a section A-A through the material shown in figure 1.

Fig 3. Shows the same cross section as in figure 2 following opening of the flaps.

Fig 4. Shows a plan view of an improved smart porous material according to the present invention, the stippled areas indicating the smart discrete areas of the material.

Fig 5. Shows a section B-B through the material shown in figure 4.

Fig 6. Shows the same cross section as in figure 5 following formation of the pocket and opening of the flaps.

A smart porous material according to the present invention is shown in figure 1 and comprises a layer (1), on which is arranged humidity sensitive discrete areas (2) which have different hydrophilic properties to the layer. These areas can be produced by plasma treatment of specific areas of the layer. Thus changing the hydrophilic properties of a relatively thin area (2) at the surface of the layer (1). The humidity sensitive discrete areas are arranged and sized so as to fit as many discrete areas on the layer as is required to give the necessary porous properties. Each discrete area and the layer beneath it is then cut, using laser

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techniques in the form of a cross (3), thus providing 4 flaps (4 a, b, c & d), two of which are shown in cross section in figure 2. When the humidity of the environment adjacent to a humidity sensitive discrete area increases the flaps will be caused to bend
5 due to the strain differences caused by the different hydrophilic properties of the layer and discrete area, as shown in figure 3, thus causing an opening(5) to be formed in the material and causing the material as a whole to become more porous. When the humidity of the environment adjacent to the same discrete area
10 decreases it will cause the flaps to straighten thus closing the opening and causing the material as a whole to become less porous, as shown in figure 2.

An improvement of the invention can be obtained by causing a further humidity sensitive discrete area (6), as shown in figures
15 4 and 5, to be formed in a hoop outside some or all of the discrete areas (2). As shown in figure 6, when the humidity of the environment adjacent to a further discrete area increases the strain differences between the layer (1) and further discrete area (6), as a result of their different hydrophilic properties, causes
20 a pocket (7) as well as the hole (5) to form in the material thus increasing the overall material's ability to transfer moisture. The hole (5) and the pocket (7) can be arranged to form at a similar humidity level or at different humidity levels.

CLAIMS

1. A smart film or material comprising at least two layers having different fluid absorption properties wherein all the layers are cut so as to provide a plurality of close fitting flaps through the film or material such that any strain differences between the layers caused by their different fluid absorption properties will cause the flaps to bend providing a plurality of openings in the layer.
2. A smart film or material comprising a layer, a surface of which has discrete areas which have fluid absorption properties different to the rest of the layer wherein the discrete areas and the layer which they cover are cut so as to provide a plurality of close fitting flaps through the film or material such that any strain difference between the discrete areas and the layer which they cover, caused by their different fluid absorption properties, will cause the flaps to bend thus providing an opening in the layer.
3. A smart film or material according to claims 1 or 2 configured so as to be suitable for use in clothing.
4. A smart film or material according to claim 2 or 3 wherein the discrete areas are produced by attaching a material having different fluid absorption properties to the layer to the surface of the layer.
5. A smart film or material according to claim 2 or 3 wherein the discrete areas are areas of the layer which have been plasma

treated or treated with chemicals or radiation so as to modify their fluid absorption properties.

6. A smart film or material according to claim 2 or 3 wherein the discrete areas are provided by a printing process.

7. A smart film or material according to claim 2 or 3 wherein the discrete areas are provided by an etching process.

8. A smart film or material according to any of the preceding claims wherein the discrete areas and the layer which they cover or all the layers are cut using a laser or a punch.

9. A smart film or material according to any of the preceding claims wherein the discrete areas and the layer which they cover or all the layers are cut so as to provide at least 3 close fitting flaps through the film or material.

10. A smart film or material according to claim 2 or 3 wherein at least some of the discrete areas are individually surrounded by a further discrete area which has fluid absorption properties different to the rest of the layer, the further discrete area being disposed from the discrete area which it surrounds.

11. A smart film or material according to claim 10 wherein at least one of the further discrete areas is provided in the form of a hoop.

12. A smart film or material according to any of the preceding claims wherein the layer or one of the layers is substantially impermeable.

13. A smart film or material according to any of the preceding claims wherein the layer or one of the layers is permeable.
14. A smart film or material according to any of the preceding claims which forms one element of a multi-element textile.
15. A smart film or material according to claim 1 or 3 wherein the layers have different hydrophilic properties to each other.
16. A smart film or material according to claim 2 or 3 wherein the layer and the discrete areas have different hydrophilic properties.
17. A smart film or material as hereinbefore described with reference to the figures 1 to 3 or figures 4 to 6.

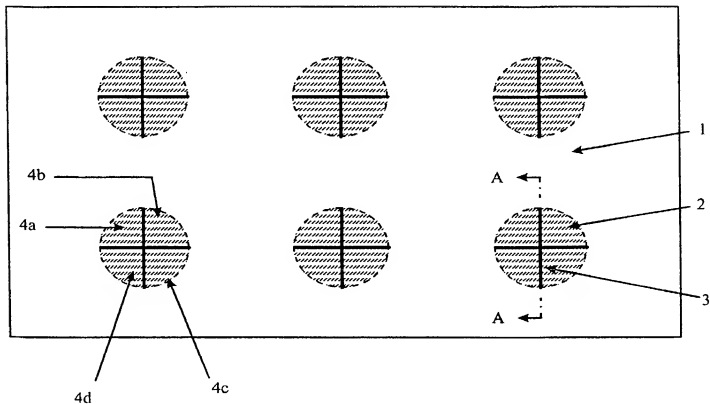
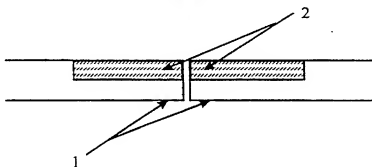
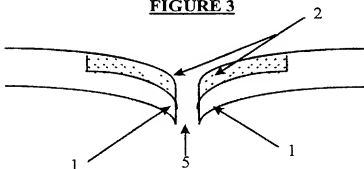
FIGURE 1FIGURE 2FIGURE 3

FIGURE 4

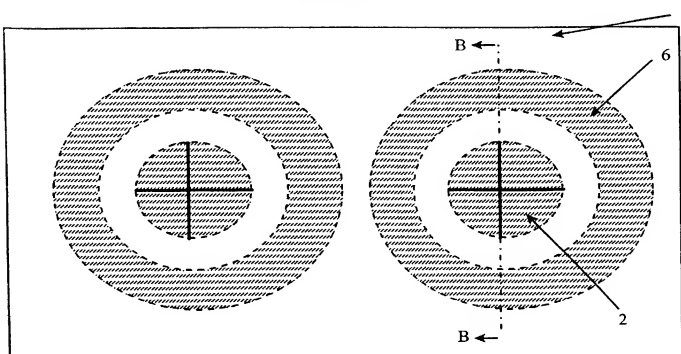


FIGURE 5

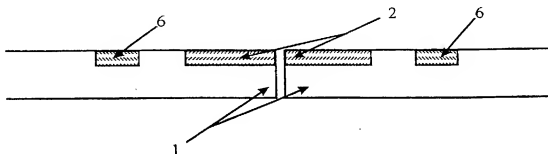
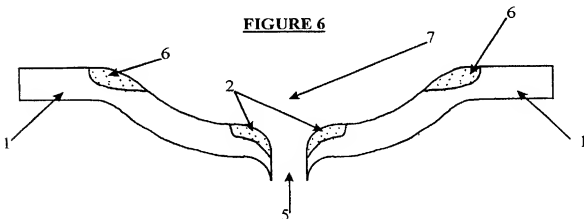


FIGURE 6



Attorney Docket No. _____

DECLARATION FOR PATENT APPLICATION☐ Original☐ Supplemental☐ Substitute☐ PCT

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below), or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

SMART POROUS FILM OR MATERIAL

the specification of which (check one)

☐ is attached hereto☐ was filed on _____ as U. S. Application Serial Number _____☐ was filed as PCT International Application Number PCT/GB99/01470 on 10 May 1999

and was amended under PCT Article 19 on _____

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 (a) - (d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified, by checking the box below, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Applications			Priority Claimed		Copy Attached	
Application Number	Country	Foreign Filing Date	YES	NO	YES	NO

I hereby claim the benefit under Title 35, United States Code § 119(c) of any United States provisional application(s) listed below and claim the benefit under Title 35, United States Code, § 120 of any United States application(s), or § 365(c) of any PCT international application(s) designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

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 For: "
 Inventors:
 Filed:
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 Page 2

Parent Application Number	Filing Date	Status (Mark Appropriate Column Below)		
		Patented	Pending	Abandoned
PCT/GB99/01470	10 May 1999		Pending	

As a named inventor, I hereby revoke all prior powers and appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

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Bernard J. Graves, Jr.	33,239
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Bruce D. Gray	35,799
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J. Michael Boggs	P46,563
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Kyle M. Globerman	P46,730
Tywanda L. Harris	P46,758
Kristin D. Mallatt	P46,895
Cynthia B. Rothschild	P47,040

I acknowledge the above-listed attorneys and agents and their firm Kilpatrick Stockton LLP represent my employer (if I am an employee and this application has been or will be assigned to my employer) or the entity with which I have contracted (if I am an

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Page 3

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Full name of second inventor _____
Inventor's signature _____ Date _____
Residence _____
Citizenship _____
Post Office Address _____

Attorney Docket No. _____

DECLARATION FOR PATENT APPLICATION☐ Original☐ Supplemental☐ Substitute☐ PCT

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